

# UNPUBLISHED PRELIMINARY DATA

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PROGRESS REPORT on NASA Research Grant NsG 350  
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The single fluid analysis of an M.H.D. travelling wave channel has been considered after the analysis of Fischbeck and Lessen<sup>1</sup>. First order calculations for a propulsion device have yielded some numerical values for constant magnetic field velocity of the flux density, coil configuration, conductivity required, power supply requirements etc. From this point a detailed analysis has been completed for the boundary value problem of the travelling wave field configuration. The boundary conditions for this analysis were a combination of Neumann and Dirichlet conditions for the vector potential. This analytical result has been used to determine the current linear density requirement for the magnetic field intensities of the earlier calculations.

On the basis of the calculations a first channel design has been effected and calculations are continuing to establish field winding sizes, spacings etc. During this time several commercial companies have been contacted for power supplies. To date two supplies are available, one of which will give 3 $\phi$  20KC 25KW another 2 $\phi$  20KC 20KW. The latter can be rented for a period of time and it is our intention to do so. We are currently investigating specific details of the channel with this power supply as the governing boundary condition.

Calculations have been started for the plasma production device which is anticipated to be a glow arc supply. As these are completed with our plasma requirements in mind, we shall construct a prototype of this for experimental analysis.

A three fluid analytical model with the effects of charge exchange has been formulated and the analysis of the travelling wave device with this model has been started. One finds very little information on the cross-sections of the collision processes which are involved for the gases we should like to use; as a consequence some microscopic analysis is anticipated so that collision information for the lighter<sup>weight</sup> gases can be extrapolated to Xenon for example.


Facility installation has proceeded at a modest rate in anticipation of the channel completion.

<sup>1</sup>Fischbeck, K. H. and M. Lessen, "On the Theory of Travelling Wave Magnetohydrodynamic Power Converters", Bulletin of the American Physical Society, Feb. 23, 1962 #2 Series H. Vol. 7.

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The vacuum system sphere was delivered on December 28, 1962. Erection of the sphere, mechanical pump, roughing line and necessary electrical connections were made during January. Initial roughing took place on February 1. Subsequently the diffusion pump, oil ejector pump, 35" valve and baffle have been connected into the system and the system again roughed down to 200  $\mu$ Hg pressure. A smaller system has been constructed for vacuum gauge calibration and is now in operation going to  $2 \times 10^{-6}$  mm Hg. pressure. The large system is to be leak checked shortly before pumping down with the diffusion-ejector system.

Simultaneous to this latter effort, a channel and flange have been constructed for the purpose of attaching the M.H.D. channels to the vacuum system. This too has been roughed down and some minor leaks sealed.

  
Project Supervisor